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Abstract

EXPERIENCE WITH BRADWELL AND LATINA ON-LOAD FUEL HANDLING
EQUIPMENT AND ITS INFLUENCE ON FUTURE DESIGNS

by

*J. O. Joss

+W. H. Shipley

*G. H. Branch

*J. E. Taylor

On-load fuel handling equipment at Bradwell and Latina

1. Description of the Bradwell Machinery

An outline description of the main features of the charge machine and its ancillary plant, especially of those features which required extensive development or modification during the period of design, construction and commissioning before becoming reliable devices.

2. Development of the Design for Bradwell

The original design contained features which it was realised would have to be proved by prototype testing and development. In addition, changes were required because of changes in other reactor plant items. These two factors profoundly influenced the eventual form of certain components.

3. Commissioning at Bradwell

The fuel handling plant test programme was an integral part of overall reactor commissioning with cold, hot and endurance phases, each designed to prove aspects of the detailed and general design. The defects which arose were mainly rectified in situ, but some required further development.

* The Nuclear Power Group, Knutsford, Cheshire.

+ Messrs. Strachan & Henshaw Ltd. Bristol.

4. Early Bradwell Operational Experience

Because of certain limitations found during commissioning the machinery was at first used off-load or at reduced power and temperature. Under these conditions absorbers and fuel channels were handled without trouble, and considerable experience was obtained in the use of the machinery.

When improved chutes became available, absorber handling at full power was commenced.

5. Full Operational Use of the Bradwell Machinery

After a period of absorber handling it was decided to carry out a controlled approach to full-load fuel handling. The Generating Board produced a programme for refuelling at 20%, 60% and then full power, which was carried out without incident. Mechanical trouble with the fuel grabs caused subsequent refuelling to be suspended while further development of the grabs was undertaken. Meanwhile absorber handling continued, and an incident arose when part of a shield plug assembly broke loose; as a result all such plugs required modification.

Improved grabs, became available, and full-power refuelling was resumed. Mechanical troubles persisted, but an improved indication system prevented these from developing into major incidents. Continued refuelling and further work on grab design continues in parallel.

6. The Latina Machinery as a Development of Bradwell

While basically the same, the Latina charge machines have taken full advantage of the Bradwell design, development, testing and commissioning experiences. As a result of this, much less time was spent in setting the equipment to work on site.

7. On-load Working at Latina

Virtually no on-load handling of fuel elements has yet been carried out, but a considerable number of absorber channels have been changed without incident.

8. The Dungeness and Oldbury Machinery

Following the pattern of continued evolution, the more-or-less identical Dungeness and Oldbury machinery is based on the Latina design, incorporating features to eliminate disadvantages which became apparent through the operation of the earlier designs. Much greater use has been made of test rigs giving improved simulation of reactor conditions in the proving in prototype and production form of component parts and complete machines.

9. Lessons for the Future

The paper shows the main requirements for good fuel-handling machinery design, not all of which were obvious when Bradwell and Latina were designed. Much of this knowledge is applicable to AGR as well as to Magnox reactors.

10. Control by Computer

In addition to the mechanical requirements, improvements in control systems can add much to safety, speed and convenience of operation. The application of a digital computer to a refuelling system of the Bradwell type is described and discussed.